

Future unpolarized e(p) experiments

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PERLE Physics Workshop May 2022



Center for Frontiers
in Nuclear Science



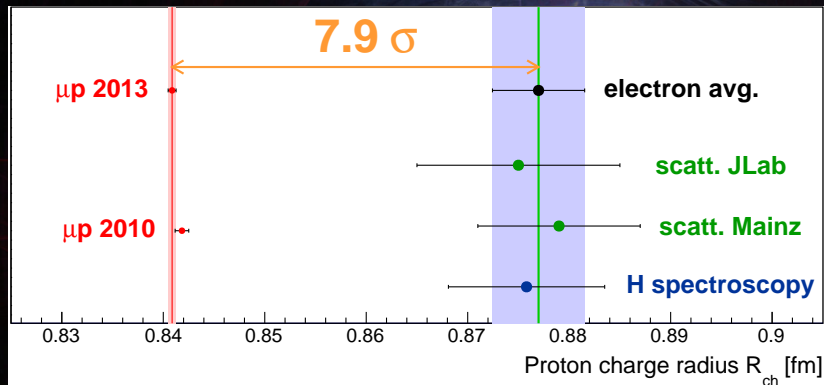
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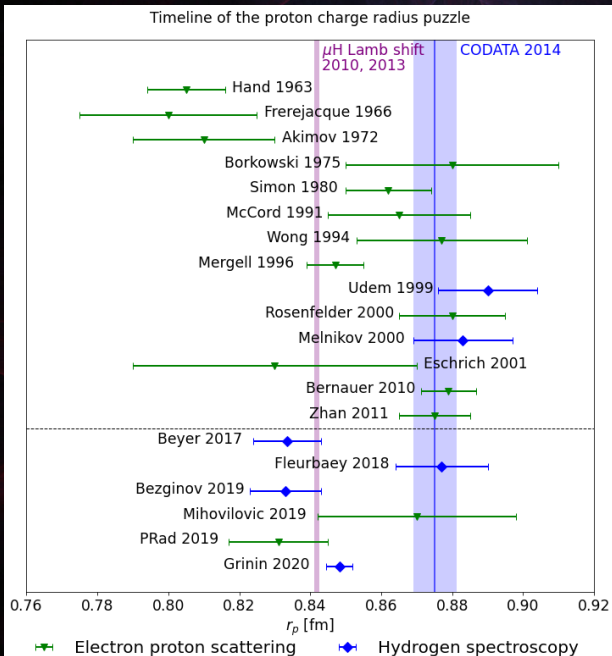
**Stony Brook
University**

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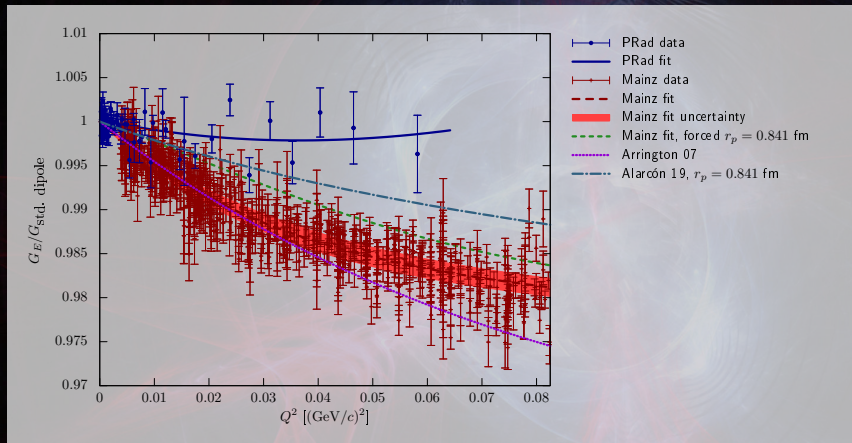
Proton form factors: Proton radius



New results

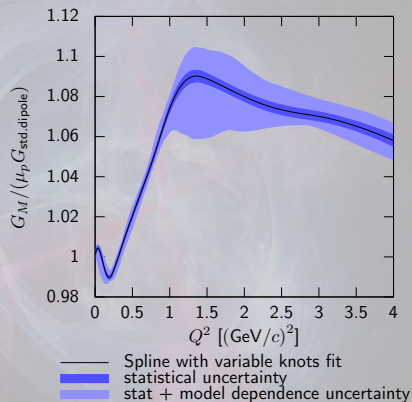
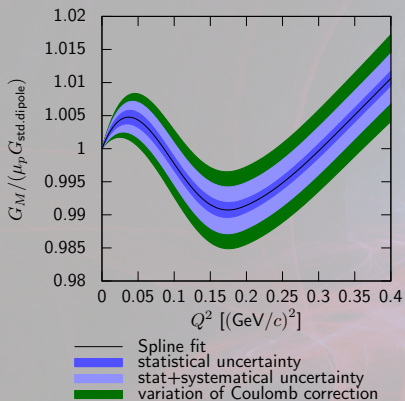


A different puzzle?

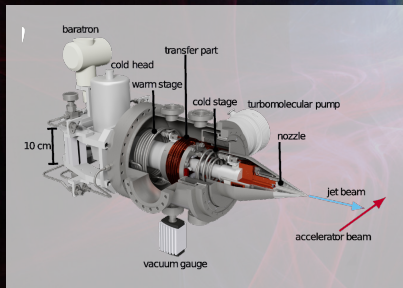


Who is right? What happens at larger Q^2 ?

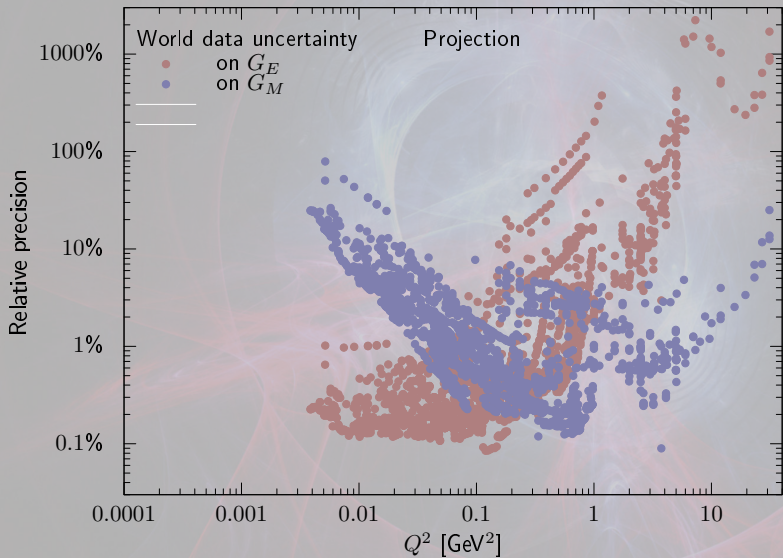
Magnetic form factor structures



Better targets: Gas jet target



What do we know (ca 2010)

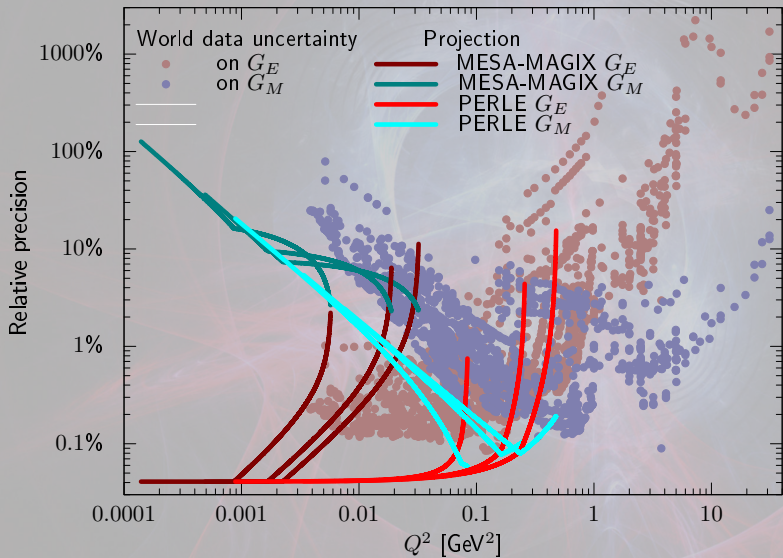


What we could measure: Assumptions



- » MAGIX-like spectrometer
- » Mainz-like jet target
- » 10 minutes per data point
- » Max 10 kHz data rate
- » Only statistical error

What we could measure



But wait, there is more

Can do the same for other targets: ^3He , ^4He , N, O, ...
Many low hanging fruits, many overlaps with atomic
measurements!

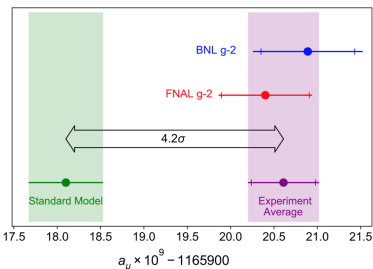
Precision BSM searches

- » So far, search for dark matter portal without success
- » Key might be precision tests of SM

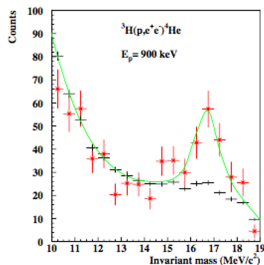
Anomalies as lamp posts

- » Can we see hints of dark matter in SM anomalies?
- » ... or other BSM physics?
- » In nuclear / particle physics:

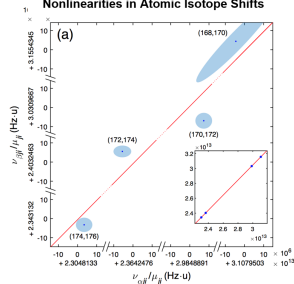
Muon g-2 Discrepancy



X17 in 4He and 8Be



Nonlinearities in Atomic Isotope Shifts



→ DarkLight at ARIEL

DL@ARIEL: Projected reach

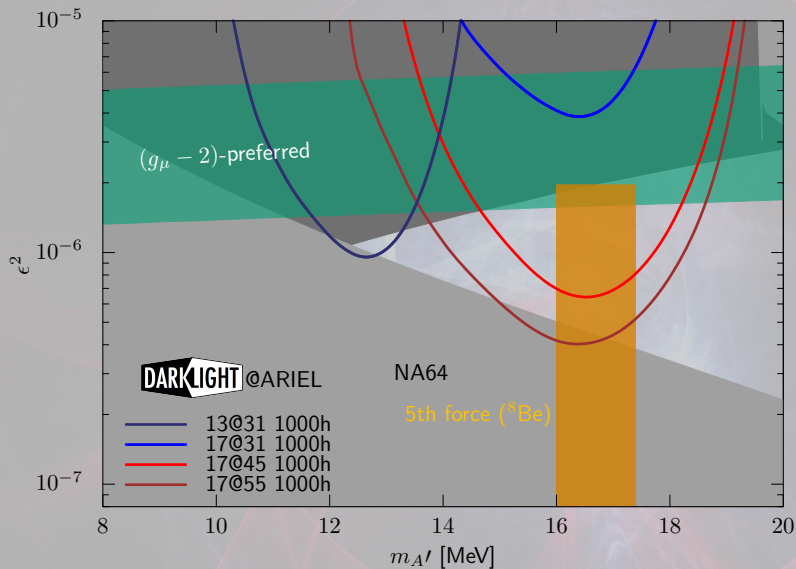


Figure of Merit

- » With solid target, quickly in regime where FoM does not scale with luminosity
 - » Random background dominates
- » Two ways to improve:
 - » higher bunch clock \rightarrow smaller coincidence window
 - » thinner target with more current \rightarrow less multiple scattering \rightarrow better mass resolution

Workshop at ARIEL!

New Scientific Opportunities at the TRIUMF ARIEL e-linac



Vancouver, Canada
May 25-27, 2022

Fundamental Physics
Innovation
AWARDS

APS
physics

GORDON AND BETTY
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Conclusion

- » Generational leap for G_E and G_M
 - » Can test G_M at small Q^2
 - » Need more energy for large Q^2 behavior
- » Opportunities for precision SM tests: Door to BSM?
- » Much more